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( Superseding IS : 2068 - 1962 )

*Indian Standard*  
SPECIFICATION FOR  
COTTON COVERED COPPER CONDUCTORS  
PART II RECTANGULAR CONDUCTORS

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# Indian Standard

## SPECIFICATION FOR COTTON COVERED COPPER CONDUCTORS

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*Indian Standard*

**SPECIFICATION FOR**  
**COTTON COVERED COPPER CONDUCTORS**

**PART II RECTANGULAR CONDUCTORS**

**0. FOREWORD**

**0.1** This Indian Standard (Part II) was adopted by the Indian Standards Institution on 20 August 1974, after the draft finalized by the Winding Wires Sectional Committee had been approved by the Electrotechnical Division Council.

**0.2** The cotton covered rectangular copper conductors were originally covered in IS : 2068-1962 which is now being superseded by this standard. This standard has been lined up (especially the dimensional aspects) with IS : 6160-1971\* which is based on the latest IEC Recommendations. To cover adequately the properties of cotton yarn, a reference has been made to IS : 3567-1966†. A recommendatory sampling plan and criteria for acceptance of lot is also included in Appendix A.

**0.2.1** This standard (Part II) covers cotton covered rectangular copper conductors. Cotton covered round copper conductors are covered in Part I of this standard.

**0.3** For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test, shall be rounded off in accordance with IS : 2-1960‡. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

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**1. SCOPE**

**1.1** This standard (Part II) covers the requirements for rectangular copper conductors covered with cotton yarn.

**1.1.1** It does not apply to rectangular conductors covered with cotton braiding.

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\*Specification for rectangular conductors for electrical machines.

†Specification for cotton yarn for covering conductors.

‡Rules for rounding off numerical values (*revised*).

**1.2** The requirements of the standard are applicable to conductors having thicknesses from 0.80 up to and including 5.6 mm and widths from 2 up to and including 16 mm. A schedule of preferred sizes is given in IS : 6160-1971\*.

## **2. TERMINOLOGY**

**2.0** For the purpose of this standard, the following definitions shall apply.

**2.1 Wire** — The insulated material as received.

**2.2 Conductor** — The bare metal after removal of the cotton covering.

**2.3 Increase in Dimensions Due to the Covering** — The difference between the thickness over the cotton covering and the corresponding dimension of the conductor.

**2.4 Tolerance** — The permissible divergence of an actual magnitude from that prescribed.

## **3. GRADES**

**3.1** The wire shall be classified into two grades as follows:

- a) Double, Ordinary ( O ); and
- b) Double, Fine ( F ).

## **4. GENERAL TEST CONDITIONS**

**4.1** Unless otherwise specified, all tests shall be carried out within a temperature range of 15 to 35°C, and a relative humidity range of 45 to 75 percent. Before measurements are made, the specimens shall be preconditioned under these atmospheric conditions for a time sufficient to allow specimens to reach stability.

**4.2** The wire to be tested shall be removed from the packaging in such a way that the wire will not be subjected to tension or unnecessary bends.

**4.3** Before each test, sufficient length of wire shall be discarded to ensure that any damaged wire is not included in the test specimens.

**4.4** When no specific range of sizes is given for a test, the test is applicable to all sizes.

## **5. CONDUCTOR**

**5.1** The conductor shall conform to **3.1** of IS : 6160-1971\*.

## **6. COTTON**

**6.1** The cotton yarn shall comply with the requirements of IS : 3567-1966†.

\*Specification for rectangular conductors for electrical machines.

†Specification for cotton yarn for covering conductors.

## 7. APPLICATION OF COTTON COVERING

**7.1 General** — The conductor shall be completely and uniformly covered with *two* layers of cotton.

**7.2 Arrangement of Layers** — The cotton covering shall be lapped firmly, evenly, closely and continuously round the conductor. The two layers shall be applied in opposite directions.

## 8. INCREASE IN DIMENSIONS

**8.1 Increase in Dimensions** — The increase in dimensions due to covering shall be between the following limits:

Grade	Increase mm
Double, Ordinary (O)	0.46 and 0.51
Double, Fine (F)	0.36 and 0.43

**8.2 Measuring Equipment** — The measurement shall be made with an accuracy better than 0.002 mm. If a micrometer is used, it shall be ensured that the measuring force is in the range of 0.75 to 3.0 N. The spindle and the anvil of the micrometer shall have a diameter of 5 to 8 mm.

### 8.3 Measuring Method

**8.3.1 Overall Dimensions** — Measurements shall be made of the smaller dimension of the covered conductor at three positions not less than 100 mm apart. The measurements shall be made on completely straight parts of the wire.

Where the larger dimension of the covered conductor is greater than the diameter of the micrometer spindle, measurements shall be made at the centre of the wire.

The average of the three results shall be reported as the 'overall thickness'.

**8.3.2 Conductor Dimensions** — The covering shall be removed by any method which does not damage the conductor for the three positions used for measurements in **8.3.1** and the conductor dimensions measured at these positions.

The average of the three results shall be reported as the 'conductor thickness'.

**8.3.3 Increase in Dimensions Due to Cotton Covering** — The difference between the overall thickness and the conductor thickness shall be reported as the 'increase in thickness'.

**NOTE** — The measurement across the larger dimension is under consideration.

## 9. MANDREL WINDING TEST

**9.1** Samples of cotton covered conductors shall be bent through  $180^\circ$  round a mandrel having a diameter 8 times the bare width of the conductor, when it is bent on edge or 8 times the bare thickness, when it is bent on flat. Separate samples shall be bent, two on edge and two on flat and when so tested, the cotton covering shall not open sufficiently to expose the conductor of the inner layer to view, when examined under diffused light by normal eyesight.

## 10. PACKING AND MARKING

**10.1** The wire shall be tightly and evenly wound on drums complying with IS : 2069-1962\*.

**10.1.1** The wire on each reel shall be in one continuous length.

**10.2** The label which is to be securely attached to the drum shall have the following information:

- a) Manufacturer's name or trade-mark,
- b) Grade of covering,
- c) Conductor dimensions,
- d) Increase in dimensions due to covering, and
- e) Weight of wire (gross and net).

**10.2.1** The label may also be marked with the ISI Certification Mark.

NOTE — The use of the ISI Certification Mark is governed by the provisions of the Indian Standards Institution (Certification Marks) Act and the Rules and Regulations made thereunder. The ISI Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well-defined system of inspection, testing and quality control which is devised and supervised by ISI and operated by the producer. ISI marked products are also continuously checked by ISI for conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of the ISI Certification Mark may be granted to manufacturers or processors, may be obtained from the Indian Standards Institution.

## APPENDIX A ( Clause 0.2 )

### RECOMMENDED SAMPLING PLAN AND CRITERIA FOR ACCEPTANCE OF LOT

#### A-1. LOT

**A-1.1** In any consignment all the drums of the same type, size and manufactured from the same material under essentially similar conditions of production shall be grouped together to constitute a lot.

\*Specification for drums for covered winding wires and strips for electrical purposes.

## A-2. SCALE OF SAMPLING

**A-2.1** For judging the conformity of a lot to the requirements of the specification, tests shall be done for each lot separately. For this purpose the number of drums to be selected at random from lot shall be in accordance with Table 1.

**TABLE 1 SCALE OF SAMPLING AND PERMISSIBLE NUMBER OF DEFECTIVES**

LOT SIZE	FOR PHYSICAL CONSTANTS AND DIMENSIONS		FOR RESISTANCE, ELONGATION AND FREEDOM FROM DEFECTS	
	Sample Size	Permissible No. of Defectives	Sample Size	Permissible No. of Defectives
(1)	(2)	(3)	(4)	(5)
Up to 300	20	0	13	0
301 to 500	32	1	20	0
501, 1 000	50	2	32	1
1 001, 3 000	80	3	50	2
3 001 and above	125	5	80	3

## A-3. NUMBER OF TESTS AND CRITERIA FOR ACCEPTANCE

**A-3.1** From each of the drums selected according to col 2 of Table 1, suitable lengths of test samples shall be taken after discarding approximately 1.5 m of the conductor from both ends. Each of these test samples shall be subjected to the measurements of dimensions and physical constants (see 5.1). The number of test samples not fulfilling the requirements of any of these tests shall be less than or equal to the corresponding permissible number given in col 3 of Table 1.

**A-3.2** For the test for resistance, elongation and freedom from defects of conductors, the number of tests to be carried out and the permissible number of defectives for each of these characteristics shall be in accordance with col 4 and 5 of Table 1.

NOTE — The test samples for the purpose **A-3.2** may be chosen from the drums already selected for the purpose of **A-3.1**.

**A-3.3** For testing the cotton quality, the number of drums to be selected as a sub-sample from the original one drawn under **A-2.1** shall be 5 when the lot size is 500 and below and 10 when the lot size is 500. All these shall pass the test if the lot is to be accepted under this clause.

**A-3.4** If the requirements of **A-3.1** and **A-3.2** are met with, the lot shall be accepted.

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## ON

### WINDING WIRES

IS:

482-1968 Reels for covered, round electrical winding wires (*second revision*)  
2069-1962 Drums for covered winding wires and strips for electrical purposes  
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4685 (Part I)-1968 Varnish bonded glass-fibre covered copper conductors: Part I Round wires  
4685 (Part II)-1971 Varnish bonded glass-fibre covered copper conductors: Part II Rectangular conductors  
4800 (Part I)-1968 Enamelled round winding wires: Part I Conductor data  
4800 (Part II)-1968 Enamelled round winding wires: Part II Maximum overall diameters  
4800 (Part III)-1968 Enamelled round winding wires: Part III Methods of tests  
4800 (Part IV)-1968 Enamelled round winding wires: Part IV Wires with high mechanical properties  
4800 (Part V)-1968 Enamelled round winding wires: Part V Wires for elevated temperatures  
4800 (Part VI)-1968 Enamelled round winding wires: Part VI Wires with self-fluxing properties  
4800 (Part VII)-1970 Enamelled round winding wires: Part VII Wires with good dielectric properties under humid conditions  
4800 (Part VIII)-1970 Enamelled round winding wires: Part VIII Wires for use in refrigeration systems  
4800 (Part IX)-1971 Enamelled round winding wires: Part IX Wires with temperature index 180  
5825-1970 Guide for evaluation of thermal endurance of enamelled wires  
6160-1971 Rectangular conductors for electrical machines  
6162 (Part I)-1971 Paper covered aluminium conductors: Part I Round conductors  
6162 (Part II)-1971 Paper covered aluminium conductors: Part II Rectangular conductors  
6181-1971 Varnish bonded glass-fibre braided rectangular copper conductors  
7391 (Part I)-1974 Cotton covered copper conductors: Part I Round conductors  
7391 (Part II)-1974 Cotton covered copper conductors: Part II Rectangular conductors  
7404 (Part I)-1974 Paper covered copper conductors: Part I Round conductors  
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